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**Ritchie**

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(54) **SYSTEM FOR OBTAINING STATE INFORMATION FROM CONSUMER ELECTRONIC DEVICES**

(75) Inventor: **Jonathan G. Ritchie**, Tualatin, OR (US)

(73) Assignee: **Intel Corporation**, Santa Clara, CA (US)

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This patent is subject to a terminal disclaimer.

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(51) **Int. Cl.**  
**H04N 7/18** (2006.01)

(52) **U.S. Cl.** ..... **348/61**; 348/211

(58) **Field of Classification Search** ..... 348/61, 348/207.11, 207.1, 211.4, 211.6, 180, 212, 348/213, 160, 143, 159, 156, 155, 153, 565, 348/154, 254, 223, 187, 181; 382/100, 190, 382/192; 386/83; 379/102.01, 102.02, 102.03; 725/14, 21

See application file for complete search history.

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*Primary Examiner*—Tung Vo

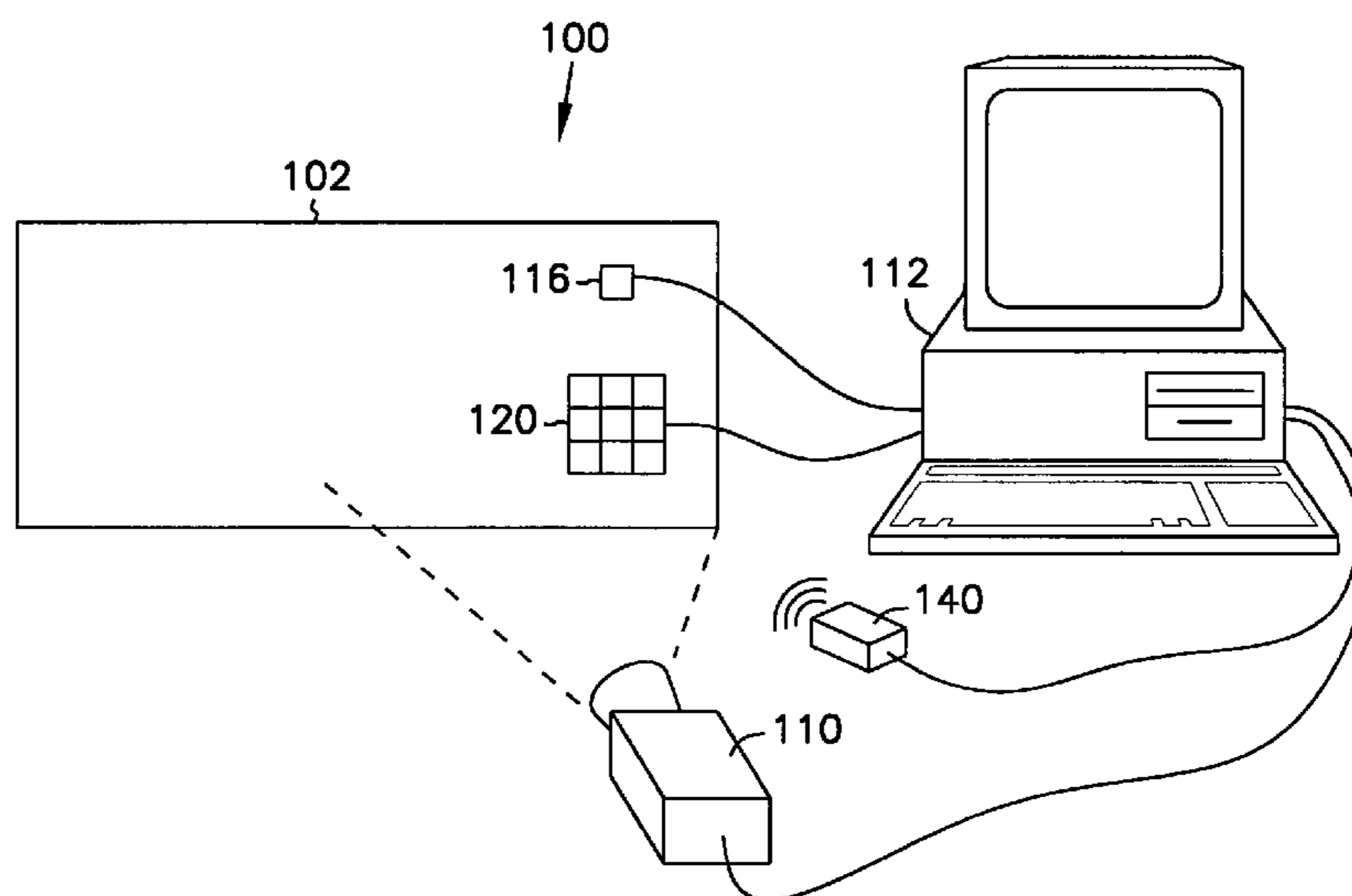
*Assistant Examiner*—Behrooz Senfi

(74) *Attorney, Agent, or Firm*—Schwegman, Lundberg & Woessner, P.A.

(57) **ABSTRACT**

A system and method of determining an operating state of a consumer electronic device allows a computer to control the consumer electronic device without user input. The system includes an image detection device for obtaining in image of the consumer electronic device. The image detection device can be a camera, or other sensor such as a photocell(s). A processor, or personal computer, is coupled to the image detection device for extracting information from a consumer electronic device display image. The processor generates control instructions for the consumer electronic device, and provides the control instructions to an infrared transmitter for transmitting the control instructions to the consumer electronic device.

**15 Claims, 2 Drawing Sheets**



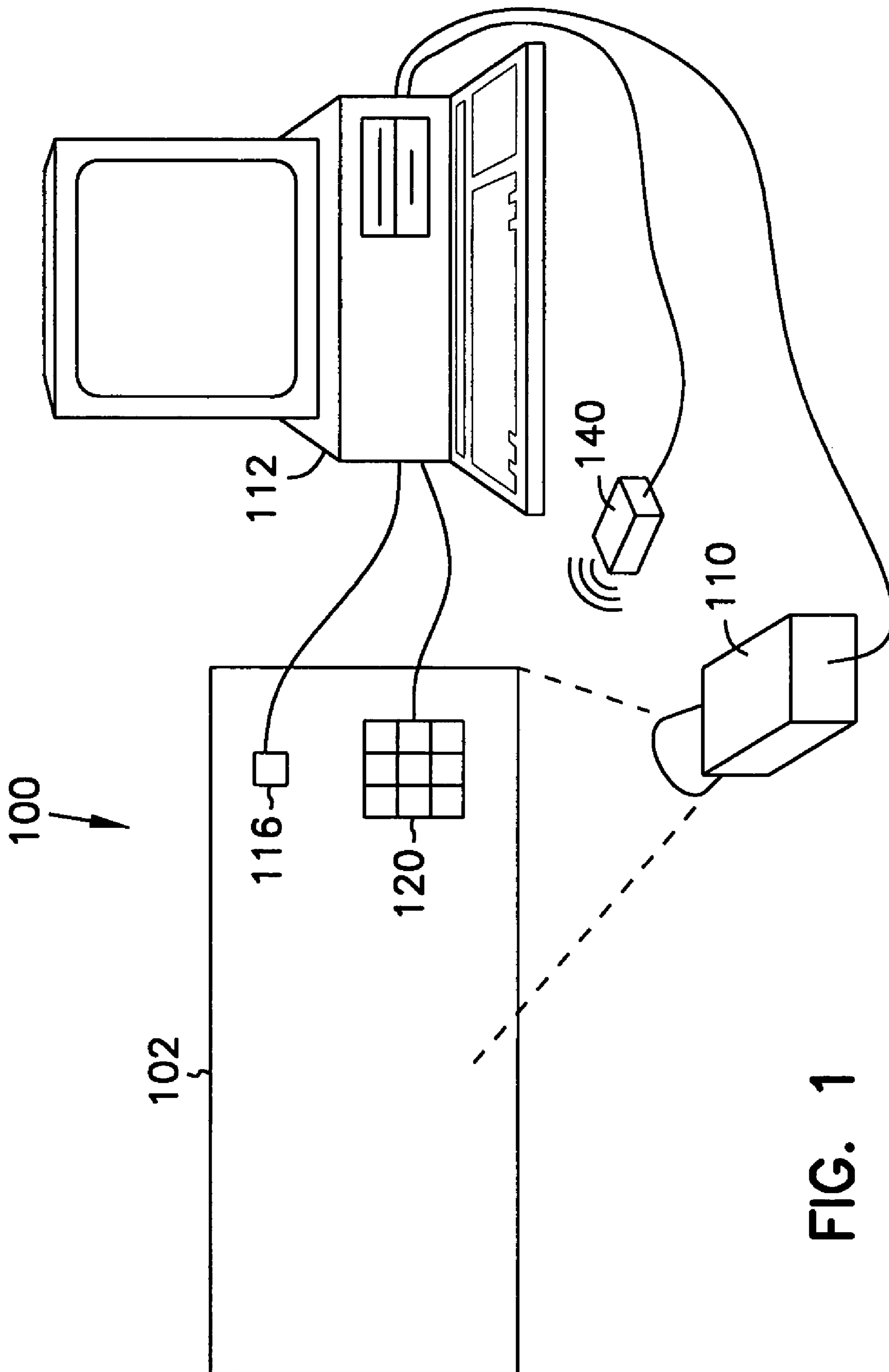


FIG. 1

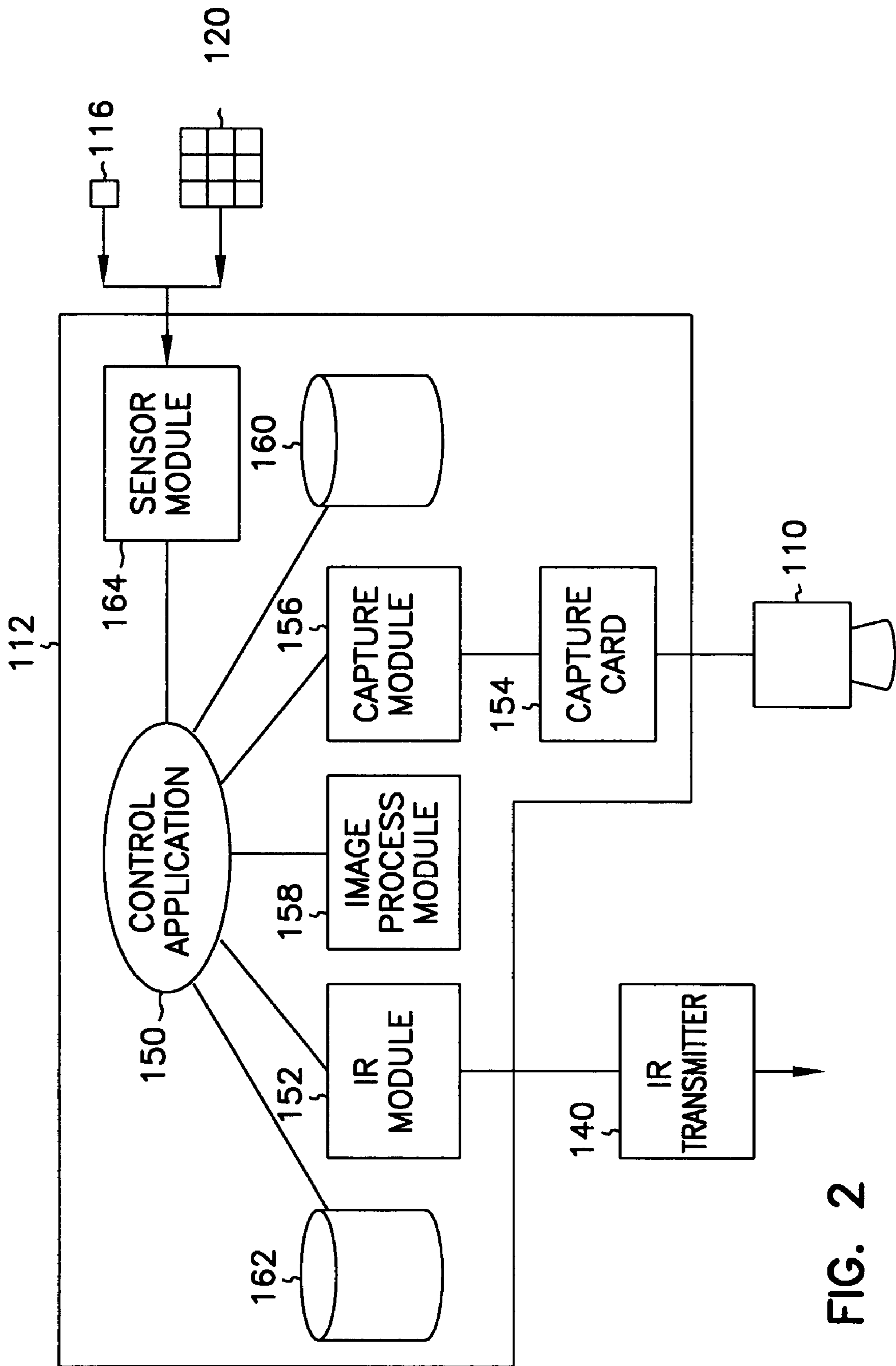


FIG. 2

## 1

**SYSTEM FOR OBTAINING STATE  
INFORMATION FROM CONSUMER  
ELECTRONIC DEVICES**

This application is a continuation of U.S. patent applica-  
tion Ser. No. 09/219,134, filed on Dec. 22, 1998, now issued  
as U.S. Pat. Ser. No. 6,784,918, which is incorporated herein  
by reference.

TECHNICAL FIELD OF THE INVENTION

The present invention relates generally to processor-based  
systems and in particular the present invention relates to  
controlling entertainment equipment using a processor.

BACKGROUND OF THE INVENTION

Modern personal computers can be augmented with hard-  
ware and software such that the personal computer can con-  
trol other home devices such as televisions, video recorders,  
lights, heating and air conditioning systems, and other similar  
devices. As such, the personal computer's powerful comput-  
ing environment allows a wide variety of device control fea-  
tures. For example, the personal computer could be imple-  
mented using a single command feature "Watch Video." This  
feature could cause the television, video recorder, and audio  
system to turn on, the video recorder to begin playing, and the  
television and audio system to select the proper input channel.  
Further, the lights in the room can be turned down by the  
processor to provide a more enjoyable viewing environment.

The personal computer typically controls external devices  
using the control protocol supported by each device. Several  
different control protocols are currently available. Although  
many external devices use different control protocols, the  
personal computer is capable of controlling a wide variety of  
devices by simultaneously supporting multiple control proto-  
cols.

The most common classes of controllable devices in house-  
holds today are consumer electronic devices such as televi-  
sions, VCRs, stereo equipment, and home theater systems.  
Most consumer electronic devices support Consumer Infra-  
red (IR) which consists of numerous proprietary control pro-  
tocols. Consumer IR allows consumer electronic devices to  
be remotely controlled using a hand-held remote. For exam-  
ple, a user can change channels on a television by press-  
ing the "Channel Up" button. When this button is pushed, the  
remote control sends an infrared command to the television,  
and the television increments its channel.

Infrared transmitter hardware can be added to personal  
computers (PC) to control consumer electronic devices. This  
allows the PC to mimic remote controls of various CE  
devices. Thus, the PC can autonomously control CE devices.  
However, a problem is encountered in controlling current  
consumer electronic devices. Specifically, Consumer IR  
assumes that a person controlling the consumer electronic  
device is able to observe the present state of the device, and  
adjust the command sequence accordingly. For example,  
most video recorders support a single "Power" command.  
This command changes the power state of the device, such  
that if the video recorder is off, the power command turns the  
device on. Likewise, if the video recorder is turned on, the  
power command turns the device off. Therefore, in order to  
get a device (e.g. the VCR) into a particular power state (on or  
off) it is essential that the person controlling the device know  
whether a consumer electronic device is already turned on.  
Similarly, to fully control consumer electronic device opera-

## 2

tions, a personal computer adapted to transmit IR commands  
needs to know the present state of the consumer electronic  
device.

For the reasons stated above, and for other reasons stated  
below which will become apparent to those skilled in the art  
upon reading and understanding the present specification,  
there is a need in the art for a system and method of deter-  
mining an operating state of a consumer electronic device  
such that it can be controlled by a personal computer.

SUMMARY OF THE INVENTION

The above mentioned problems with controlling consumer  
electronic devices and other problems are addressed by the  
present invention and will be understood by reading and  
studying the following specification.

In particular, the present invention describes a system for  
automatic control of a consumer electronic device. The sys-  
tem comprises an image detection device for obtaining an  
image of a consumer electronic device display, a processor  
coupled to the image detection device for extracting informa-  
tion from the image of the consumer electronic device display  
and providing control instructions for the consumer elec-  
tronic device, and an infrared transmitter for transmitting the  
control instructions to the consumer electronic device.

In another embodiment, a system for controlling a con-  
sumer electronic device comprises a camera for obtaining an  
image of the consumer electronic device, wherein the image  
comprises visual indications of an operating state of the con-  
sumer electronic device. The system includes a computer  
coupled to the camera for receiving the image and determin-  
ing at operating state of the consumer electronic device based  
upon the image, a database containing instructions for chang-  
ing the operating state of the consumer electronic device, and  
a transmitting device for transmitting the instructions to the  
consumer electronic device using infrared signals.

In yet another embodiment, a method is described for  
controlling a consumer electronic device using a processor.  
The method comprising obtaining an image of the consumer  
electronic device, wherein the image comprises visual indi-  
cations of a first operating state of the consumer electronic  
device, decoding the image to determine the first operating  
state, generating control signals in response to the first oper-  
ating state, and transmitting the control signals to the con-  
sumer electronic device to change the consumer electronic  
device to a second operating state.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a consumer electronic device and a cam-  
era; and

FIG. 2 is a block diagram of a consumer electronic control  
system.

DETAILED DESCRIPTION OF THE INVENTION

In the following detailed description of the preferred  
embodiments, reference is made to the accompanying draw-  
ings which form a part hereof, and in which is shown by way  
of illustration specific preferred embodiments in which the  
inventions may be practiced. These embodiments are  
described in sufficient detail to enable those skilled in the art  
to practice the invention, and it is to be understood that other  
embodiments may be utilized and that logical, mechanical  
and electrical changes may be made without departing from  
the spirit and scope of the present inventions. The following

detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined only by the appended claims.

To overcome the one-way limitation of consumer infrared control, a personal computer (processor) should determine a current state of a consumer electronic device in which control is desired. The processor is not limited to a traditional desk top computer. The present invention allows the personal computer to determine the current state of the consumer electronic device by using image processing techniques. One embodiment allows the personal computer to capture a live digital image of a physical device and apply various image processing techniques to determine the device's current operating state. For example, if a personal computer is trying to activate a video recorder, the personal computer can capture a digital image of the video recorder's front panel display. Applying video processing techniques, the personal computer can locate and identify individual icons displayed on the video recorder's front panel display. The existence or absence of certain icons can be used to determine the current state of the video recorder. Once the current state of the device is known, the personal computer can issue appropriate commands to place the video recorder into a desired state. For instance, if the only icon being displayed by the device is the "time of day" clock, the personal computer can determine that the video recorder is powered off. If the personal computer detects other icons, it can be determined that the video recorder is turned on. Using this information, the personal computer can accurately determine how to get the video recorder turned on (either by issuing a "power" command, or doing nothing).

FIG. 1 illustrates different ways in which a personal computer can determine an operating state of a consumer electronic device 100 using an image detection device, such as a camera or sensor. Again, the consumer electronic device can be a television, video recorder, stereo, home theater system, or the like. The consumer electronic device has a front panel, or display 102. This display provides visual feedback, or operating state indication, to a user. For example, when the consumer electronic device is a television, a current station and volume setting is typically displayed on the television screen. A camera 110 is provided, in one embodiment, having a field of view including the consumer electronic device to capture a video image of the consumer electronic device front panel. The camera is connected to a personal computer 112, as described in greater detail below. In another embodiment, an optical sensor 116 is provided to detect a light, or LED, provided on the consumer electronic device. The optical sensor is coupled to the personal computer. In another embodiment, an array of optical sensors 120 is coupled to the consumer electronic device and the personal computer.

Assuming that the consumer electronic device is a video recorder (VCR), the VCR can be controlled by the personal computer using an infrared transmitter. The infrared transmitter 140 is connected to the personal computer using one of several mechanisms including a serial port, universal serial bus (USB), or a powerline network, FIG. 2. The infrared transmitter is aimed at the VCR's infrared receiver (usually located on the front of the VCR) and generates consumer IR commands that mimic the device's hand-held remote control. A device control application 150, being executed by the personal computer, controls an infrared transmitter software module 152. Control commands are determined using the consumer IR database 162. The infrared transmitter software module then forwards commands to infrared transmitter hardware 140.

To capture a digital image of the VCR's front panel display, a video camera 110 is connected to the personal computer 112 using one of several options including a standard video capture card 154. The camera is aimed and focused on the VCR's front panel and sends a continuous video image stream to capture card 154. When the control application needs to determine a current state of the VCR, video capture software module 156 captures a digital image of the VCR's front panel display. The captured digital image is sent to image processing module 158 along with a description of various icons that can be displayed on the VCR's front panel. These icon descriptions are stored in database 160 and include information such as icons' location, shape, color, etc. Using these icon descriptions, the image processing module compares the digital image with possible VCR icons to determine which icons are currently displayed. An image processing software module 158 is provided for processing the digital video image captured from the camera.

Photocell 116, or photocell array 120 are used in a similar manner to provide information to the personal computer via wired or wireless communication. A sensor software module 164 can be executed by a control application 150 to determine a current state of the consumer electronic device. For example, a single photocell can be positioned on a front display of a television to indicate whether the television is turned on or off. Similarly, a photocell could be positioned to a light in the house or location of the PC such that the PC can control the light (on, off or brightness). Likewise, photocell array 120 can provide additional information by placing the array on icon display areas of the consumer electronic device.

The present system allows a personal computer to determine a present state of consumer electronic devices, including VCRs, and accurately control the device without any user intervention. By enabling the personal computer to determine the state of existing consumer electronic devices, the personal computer can provide a wide variety of device control applications using the millions of existing devices currently installed in people's homes.

A system and method of determining an operating state of consumer electronic devices have been described herein such that a personal computer can control the consumer electronic device without user input. The system includes an image detection device for obtaining an image of the consumer electronic device. The image detection device can be a camera, or other sensor such as a photocell(s). A processor is coupled to the image detection device for extracting information from a consumer electronic device display image. The processor generates control instructions for the consumer electronic device, and provides the control instructions to an infrared transmitter for transmitting the control instructions to the consumer electronic device. This application is intended to cover any adaptations or variations of the present invention. Therefore, it is manifestly intended that this invention be limited only by the claims and the equivalents thereof.

What is claimed is:

1. A system, comprising:

- an image detection device to obtain an image of a consumer electronic device;
- a transmitter to transmit control instructions to the consumer electronic device responsive to information extracted from the image; and
- a first database coupled to a processor, wherein the processor is to extract the information from the image, and wherein the first database comprises the control instructions to the transmitter.

2. The system of claim 1, wherein the consumer electronic device comprises a television.

## 5

3. The system of claim 1, wherein the consumer electronic device comprises a video recorder, and the image includes a front panel of the video recorder.

4. The system of claim 1, wherein the image detection device comprises a camera having a field of view including the consumer electronic device. 5

5. The system of claim 1, wherein the image detection device comprises a plurality of photo cells attached to the consumer electronic device.

6. The system of claim 1, further comprising a second database comprising an icon table to be accessed by the processor to extract the information from the image. 10

7. A system, comprising:

a camera to obtain an image of a consumer electronic device, the image comprising at least one visual indication of an operating state of the consumer electronic device; 15

a transmitter to transmit control instructions to the consumer electronic device responsive to information extracted from the image; and 20

a database coupled to a processor, wherein the processor is to extract the information from the image, and wherein the database comprises the control instructions to the transmitter.

8. The system of claim 7, wherein the consumer electronic device comprises a video recorder.

9. The system of claim 7, wherein the consumer electronic device comprises a television.

## 6

10. A method, comprising:

obtaining an image of a consumer electronic device, wherein the image comprises at least one visual indication a first operating state of the consumer electronic device;

determining the first operating state based on information extracted from the image by a processor;

generating at least one control signal responsive to the first operating state according to a database having control instructions; and

signaling the consumer electronic device to change to a second operating state different from the first operating state using the at least one control signal and a transmitter.

11. The method of claim 10, wherein a processor decodes the image to compare the first operating state to the second operating state to generate the at least one control signal according to the database. 15

12. The method of claim 10, wherein the consumer electronic device comprises a video recorder. 20

13. The method of claim 10 wherein the consumer electronic device comprises a television.

14. The method of claim 10, further comprising:

obtaining the image using a camera.

15. The method of claim 10, wherein determining the first operating state comprises: 25

accessing a database comprising images.

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